PAPER-FLATTENING DEVICE FOR A FEEDING APPARATUS AND METHOD OF FEEDING A SHEET OF PAPER INTO A FEEDING APPARATUS

Field of the Invention

【01】The present invention relates to a paper-flattening device, more specifically to a paper-flattening device for a feeding apparatus.

Background of the Invention

【02】 Referring to Figures 1(A) and 1(B), a conventional feeding apparatus (such as a facsimile machine, a printer and a digital copier) is provided with an automatic paper-feeding mechanism 2 for feeding a sheet of paper 4 into the feeding apparatus via a feeding mouth (not visible).

【03】 As illustrated, the paper-feeding mechanism 2 includes a paper-supporting tray 10, a roller shaft 7, a feed-in roller 16, a cam shaft 18, first and second driving elements 14,20, and a cam member 8. The paper-supporting tray 10 is biased upwardly and defines an accommodating space 6 to receive a stack of paper 4 therein. The feed-in roller 16 is mounted on the roller shaft 7 so as to be disposed above the paper-supporting tray 10 for feeding the paper 4. The cam shaft 18 is disposed adjacent to and parallel with the roller shaft 7. The cam member 8 is fixed on the cam shaft 18, and presses slidably the paper-supporting tray 10 against urging action thereof so as to define a paper feeding area 3 which is disposed below the feed-in roller 16 and which is in spatial communication with the feeding mouth.

【04】The cam member 8 is driven by the first driving element 14 upon actuated, which in turn, results in rotation of the cam member 8 in a non-circular path so as to permit upward movement of the paper-supporting tray 10 by virtue of the biasing action thereof, thereby raising the paper-supporting tray 10 so as to abut the paper 4 against the feed-in roller 16. The paper 4 is fed into the feeding apparatus upon rotation of the feed-in roller 16 that is driven by the second driving element 20.

【05】One drawback of the aforesaid conventional feeding apparatus resides in that during the feeding operation, the leading corners of paper 4 may turn upward and are folded due to sliding contact with two opposite sides of the paper-supporting tray 10. The situation is aggravated in the event a used paper having one side already printed is fed into the feeding apparatus.

Summary of the Invention

【06】The object of the present invention is to provide a paper-flattening device for a feeding apparatus which is capable of slidably contacting the leading corners of advancing paper during feeding of papers into the feeding apparatus.

【07】A paper-flattening device of the present invention is used in a feeding apparatus that includes a paper-supporting tray, a roller shaft, and a feed-in roller mounted on the roller shaft above the paper-supporting tray for feeding sheets of paper into the feeding apparatus. The paper-flattening device accordingly includes: a

stationary seat unit adapted to be mounted on the feeding apparatus adjacent to the paper-supporting tray; a spindle member disposed rotatably in the stationary seat unit, and having a top end projecting upwardly from the stationary seat unit; an arm member fixed on the top end of the spindle member for co-rotation therewith, projecting transversely from the spindle member, the arm member being adapted to extend over the paper-supporting tray so as to unfold the paper; and a cam unit disposed between and coupling the seat unit and the spindle member in such a manner that rotation of the spindle member in a first direction results in movement of the spindle member together with the arm member to an upper position, in which the arm member is moved away from the paper, and that rotation of the spindle member in a second direction opposite to the first direction results in movement of the spindle member together with the arm member to a lower position, in which the arm member is moved toward the paper.

Brief Description of the Drawings

【08】The foregoing aspects and many of the attendant advantages of this invention will become more readily appreciated as the same becomes better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings, wherein:

【09】 Figure 1(A) is a perspective view of a conventional feeding apparatus provided with an automatic paper-feeding mechanism;

【10】 Figure 1(B) is an enlarged view, illustrating how a paper-supporting tray of the conventional feeding apparatus is raised upward by virtue of movement of a cam member employed therein;

【11】 Figure 2 (A) is a perspective view of the preferred embodiment of a paper-flattening device according to the present invention;

【12】 Figure 2 (B) is an exploded view of the preferred embodiment of the paper-flattening device according to the present invention;

【13】 Figure 3 is an enlarged perspective view of the preferred embodiment of the paper-flattening device according to the present invention;

【14】 Figure 4(A) is a side view of a first transmission unit employed in the preferred embodiment;

【15】 Figure 4(B) is a side view of a second transmission unit employed in the preferred embodiment;

【16】 Figure 5 illustrates how the preferred embodiment is mounted on a paper feeding apparatus; and

【17】 Figure 6 is a block diagram, illustrating connection among a sensor, a motor and the transmission unit of the preferred embodiment.

Detailed Description of the Preferred Embodiment

【18】 Referring to Figures 2(A), 2(B), and 5, the preferred embodiment of a paper-flattening device 30 according to the present invention is mounted on a feeding apparatus 90 (see Fig. 5), such as a

digital copier, and includes a stationary seat unit 36, a spindle member 32, a cam unit, and two driven shafts 38.

【19】 As illustrated, the feeding apparatus 90 (see Fig. 5) defines a feeding mouth (not visible), and includes a paper-supporting tray 93 for holding of papers 80 thereon, a roller shaft 91, and a feed-in roller 92 mounted on the roller shaft 91 above the tray 93 for feeding sheets of paper 80 into the feeding apparatus 90 via the feeding mouth.

【20】 The stationary seat unit 36 includes a pair of tubular seats 36" which are mounted respectively on two opposite sides of the tray 93.

【21】 The spindle member 32 includes a pair of spindles 32" that are disposed rotatably and respectively in the tubular seats 32" and that have two top ends projecting upwardly and respectively from the tubular seats 36".

【22】 The arm member 34 includes a pair of arms 34" that are fixed respectively to the top ends of the spindles 32" for co-rotation therewith, and that project transversely and respectively from the spindles 32". The arms 34" can extend over the paper-supporting tray 93 so as to press slidably against the corners 86 (see Fig. 5) of the paper 80.

【23】The cam unit is disposed between and couples the stationary unit 36 and the spindle member 32, and includes a cam in the form of a protrusion 52, and a helical groove 44. The protrusion 52 is mounted on an inner surface of the respective tubular seat 36". The helical groove 44 is formed on an outer surface of the respective spindle 32". The protrusion 52 of each of the tubular seats 32" slidably engages the helical groove 44 in each of the spindle 32" in such a manner that

rotation of the spindles 32" in a first direction results in movement of the spindles 32" together with the arms 34" to an upper position 82 (see Figure 5 at 82), in which the arms 34" are moved away from the paper 80, and that rotation of the spindles 32" in a second direction opposite to the first direction results in movement of the spindles 32" together with the arms 34" to a lower position 84 (see Figure 5 at 84), in which the arms 34" are moved toward the paper 80 and presses slidably against the paper 80, thereby preventing folding and curling of the paper 80 during the paper-feeding operation. The traveling length of the arms 34" can be calculated as follow: in case the angular rotational angle of the respective spindles 32" from the lower position to the upper position is (α), the angular moving length cause thereby is (X), the vertical length caused thereby is (Y), the angular length of the helical groove 44 is $L=(X^2 + Y^2)^{1/2}$. Under this condition, the angle of the helical groove 44 relative to the horizontal plane is $\Theta=\tan^{-1}[X/Y]$.

【24】 Each of the driven shafts 38 engages and drives the respective spindle 32" to rotate in the first and second directions upon being driven.

【25】 Referring to Figures 3 and 4(A), in order to drive the respective driven shaft 38, a transmission unit 76 is used for connecting the respective driven shaft 38 and the feed-in roller 92 (see Fig. 5), and includes a bevel gear 60, a driving pinion 88, a driven gear 62, a first transmission gear 66, and a second transmission gear 74. The bevel gear 60 is fixed co-axially on the driven shaft 38. The driving pinion 88 is mounted securely on one end of the roller shaft 91. The driven gear 62 is

disposed adjacent to and meshes the bevel gear 60. The first transmission gear 66 is co-axially associated with the driven gear 62. The second transmission gear 74 is disposed between and meshing with the first transmission gear 66 and the driving pinion 88, thus rotation of the feed-in roller 92 is synchronously transmitted to the respective driven shaft 38.

【26】 Referring to Figures 3 and 4(B), an alternate transmission unit 76 is used for connecting the respective driven shaft 38 and the feed-in roller 92 (see Fig. 5), and includes a bevel gear 60, a driving pinion 88, a driven gear 62, a transmission gear 66, and a toothed belt 78. The bevel gear 60 is fixed co-axially on the driven shaft 38. The driving pinion 88 is mounted securely on one end of the roller shaft 91. The driven gear 62 is disposed adjacent to and meshes the bevel gear 60. The transmission gear 66 is associated co-axially with the driven gear 62. The toothed belt 78 is trained on the transmission gear 66 and the driving pinion 88, thus rotation of the feed-in roller 92 is synchronously transmitted to the respective driven shaft 38.

【27】Referring to Figure 6, a motor (M) is provided in order to drive the roller shaft 91 via the sensor (S), and is mechanically coupled with the transmission unit 72(78). The sensor (S) is connected electrically to the motor (M) to provide a first signal to cause the motor (M) to rotate in a third direction, and a second signal to cause the motor (M) to rotate in a fourth direction opposite to the third direction. The first signal is produced by the sensor (S) upon sensing presence of and approach of the paper 80 toward the feed-in roller 92, thereby driving the feed-in

roller 92 in a clockwise direction such that the arms 34" are moved to the lower position 84 (see Figure 5 at 84), where the arms 34" slidably contact two opposite corners 86 of the paper 80 being fed into the feeding apparatus 90, thereby preventing folding and curling of the paper 80 during the paper-feeding operation. In the similar manner, the second signal is produced upon sensing finishing of paper feeding operation and absence of the paper 80 in the paper-supporting tray 93, thereby driving the feed-in roller 92 in a counter-clockwise direction such that the arms 34" are moved to the upper position 82 (see Fig. 5 at 82).

【28】 Referring to Figure 2(B) again, each of the spindles32" has an inner surface formed with a pair of axially extending grooves 40, 42. Each of the driven shafts 38 has two diametrically disposed engaging tongues 54,56 engaging the grooves 40,42 in a respective one of the spindles 32" so as to co-rotate therewith. The outer surface of each of the spindles 32 is further formed with a short axial groove 46 at its lower end thereof. The short axial groove 46 is in spatial communication with the respective helical groove 44 so as to facilitate insertion of the respective protrusion 52 into the helical groove 44 during the assembly of the paper-flattening device 30 of the present invention.

【29】 As is understood by a person skilled in the art, the foregoing preferred embodiment of the present invention is an illustration of the present invention rather than limiting thereon. It is intended to cover various modifications and similar arrangements included within the spirit and scope of the appended claims, the scope of which should be

accorded the broadest interpretation so as to encompass all such modifications and similar structure.